

Arviat Community and Housing Design Charrette

Arviat is an Inuit hamlet with a population of 2,000 that is growing quickly. There is a critical need for more housing in Arviat, which in 2002 had 252 public housing rental units. Fifty of the units had five or more occupants.

From Oct. 18 to Oct. 20, 2005, Canada Mortgage and Housing Corporation (CMHC) and the Nunavut Housing Corporation held a three-day Community Design Charrette — a brainstorming workshop — to explore important community issues, to suggest ways to relieve the housing shortage and to discuss design solutions.



Figure 1 Satellite image of Arviat

Arviat, at 60 degrees north in the Territory of Nunavut, is built on moraine gravel deposits in the west coast of Hudson Bay.

CHARRETTE PARTICIPANTS

The 40 Charrette participants included staff from Nunavut Housing Corporation's maintenance, design and delivery sections, climate change representatives from the Government of Nunavut's Department of Environment, Arviat community Elders and community members, facilitators from the Nunavut Department of Education, students and teachers from the local school and representatives of the Arviat Housing Association and the Community Health Centre. Technical consultants included an alternative energy

representative from Natural Resources Canada (NRCan) and a ventilation expert from Yukon Housing Corporation.

There was simultaneous translation from English to Inuktitut, the Inuit language, and from Inuktitut to English.



Figure 2 Igloo Sketches by Elder Donald Uluadluak

DAY ONE — COMMUNITY STRENGTHS, ISSUES AND VALUES

Arviat Elders opened the charrette with presentations about the way Inuit lived before there was government housing: the traditional Inuit hunting lifestyle and how the Inuit built igloos according to weather and snow conditions.

Inuit built their igloos on carefully elected sites on lake or sea ice — which is warmer than building on land — close to resources. Igloos protected occupants from the cold and had proper ventilation and control of humidity. The dwellings were arranged and linked to allow for both privacy and group activities. Families used the interior spaces to store and repair hunting equipment and to prepare and share food — still very important concepts for Inuit homes today.

Other presenters explained why existing housing layouts do not suit the Inuit lifestyle.

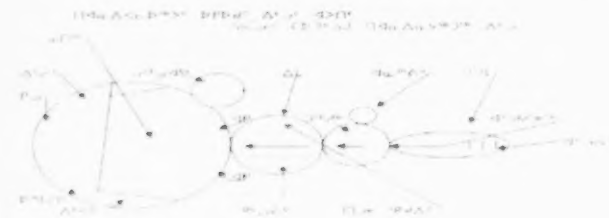


Figure 3 Plan view of traditional igloo

Following the presentations, participants broke into three groups, each led by a facilitator who also provided language interpretation. Each group discussed its understanding of Arviat's strengths, values and perceived community issues.



Figure 4 Group discussions

Community Values and Strengths

The groups decided that most valued aspects of life in Arviat include:

- The strength of the Inuktitut language;
- Self-sufficiency, resource conservation and Inuit survival skills;
- Sharing of food and shelter;
- Helping each other and working together;
- Tolerance, friendliness and a sense of humour;
- Appreciation of the Inuit culture and artistic skills, such as sewing and carving.

Community Issues

Several issues surfaced as being critical:

- Urgent need for more housing.
- Land planning and site preparation.
- Living conditions and housing design that do not provide for Inuit activities, such as the preparation of game.

- The conflict between traditional Inuit values and southern values is a source of misunderstanding.
- Inuit people are resource-conscious but do not understand their present housing systems and receive no training.
- Health is compromised by crowded living conditions, which contribute to the spread of respiratory disease and psychological problems.
- Limited health care – a doctor comes only once a month to the community.
- Climate change has affected local conditions, such as ice cover and permafrost, and there could be a rise in sea level in the longer term.
- Community design in general and specific technical issues, such as foundation design.
- Transportation for both people and materials is costly and slow.
- Materials need to be ordered well before the construction season, which contributes to the approximate two-year delay between housing design and construction.
- Nothing to do. Recreation for children and youth is a priority in community health. Young people want more access to existing facilities for sports and other cultural activities.
- Substance abuse is a problem for more than half of the young people.
- Suicide and gambling are also serious issues.
- Training opportunities for residents — in design, planning, construction, operations and maintenance — are not being included in the delivery of housing.
- There is a need for job opportunities.
- Better communications are needed between professionals and residents.

DAY TWO — FOCUS ON HOUSING

Day Two focused on housing. Presentations dealt with population, energy statistics, water treatment options, alternative energy sources, climate change and the importance of improving indoor air quality. In the afternoon, the three groups looked at ways to improve the delivery of housing and ways to reduce housing problems.

The groups identified the following problem areas within the existing housing delivery system:

- Shortage of housing is an existing and future issue. The community needs 150 units, but the Nunavut Housing Corporation could only build 15 units in 2005.
- Not enough dwelling units for singles.
- High operating costs and high energy costs.
- Each group asked: Can alternative energy be cost-effective?
- Financing and ownership.

DAY THREE — HOUSING SOLUTIONS

On the third day, the three groups explored solutions to the issues they identified on Day Two.

- Development and house construction.
- Suggestions about ways residents could contribute to lower operating costs.

- Improved housing lifespans.
- Financing and ownership possibilities.
- Appropriate new technologies.

Each of the three teams presented many ideas. The following gives the ideas. They are divided into the nine steps of housing development and delivery in Arviat and are as follows.

Step 1: Budget allocation/Financing

Issues

- Housing budget spread between many hamlets, although apportioned based on need.
- Overcrowding cannot be resolved at the present delivery rate.
- Lack of sufficient financing.

Solutions

- Encourage other private delivery agents.
- Improve design: e.g., FlexHousing™ and granny flats.
- Encourage private ownership.
- Ownership/tenancy alternatives are needed to offer different housing options— cooperatives, co-housing, self-build and rent-to-own are possibilities that could be explored. (See Finance Alternatives for more discussion.)

Finance, ownership and tenancy alternatives

- Homeownership instills a sense of pride and provides the opportunity for the occupants to choose where they live and its spatial arrangement. People value a sense of self-sufficiency. However, the cost of private housing is high. Costs include:
 - \$500/year land lease for a lot
 - \$200/ year land tax
 - \$650/month for shelter, including utilities
 - \$800/month for a standard 3-bedroom house + lot, at a cost of \$240,000. This means that a \$100,000 family income is needed to own this home and pay the mortgage. A minimum income of \$40,000 is needed to pay for a small home, but most people survive on \$20,000 a year.
- All housing, private and public, is subsidized. Should support payments be raised to lower-income people to cover their other priorities?
 - Offer forgivable loans over 10 years.
 - Flexible mortgage payments.

Public housing costs

- \$2000/month subsidy including utilities for tenants.
- Renters pay \$0.06/kwh, or \$20 per month for electricity while homeowners pay \$100 to \$300 /month, reflecting different levels of electricity subsidies.
- Provide incentive for renters if they meet a house energy-use standard. Design a utility incentive program so that both tenant and NHC gain. More money saved here could be used for construction of more houses.

Co-operative building society

- Could reduce construction costs and provide financial, maintenance, and occupancy training.
- Habitat for Humanity model of self-help and support could be explored.
- Maintenance training program is needed for homeowners. Other information in Inuktitut and English should also be provided with illustrations (as in Reader's Digest Maintenance Series).
- Provide training in financing options. Explain what is, and how to get a mortgage.

Lead organizations

- Nunavut Legislative Assembly
- Nunavut Housing Corporation, Indian and Northern Affairs Canada (INAC)
- Infrastructure Canada (CMHC verifies the house energy-efficiency design for Infrastructure Canada)
- Credit Unions, banks

Step 2: Identification of acceptable sites

Issues	- Available sites are on drained ponds — low-lying and re-fill with water, causing more frost heave, risk of flooding - Arviat Housing Association (AHA) determines site locations. - Is the present method of lot development the most effective? Should it be a single entity (uniform and appropriate, such as the NHC) versus more skilled private contractors?
Solutions	- Identify best practices for site selection and preparation - Explain appropriate techniques to decision-makers
Lead organizations	- The Hamlet of Arviat - Local builders

Step 3: Surveying

Issues	- No local surveying skills - There is a lack of local skills in land surveying and this slows development practice since the surveyors are flown in from elsewhere.
Solutions	Offer onsite training to develop technical skills in land surveying and building inspections in the community. This is an employment opportunity as well.
Lead organizations	- Hamlet - AHA, Community consultation - Nunavut Planning Department - Community college, high school

Step 4: Site preparation, roads

Issues	- Lack of good housing sites - Controversy over drainage and fill of low-lying ponds - Lack of appropriate graded gravel nearby —expensive to haul in - Need one year for fill to settle — acute housing need has led to overlooking this requirement - Foundations heave post-construction
Solutions	- Investigate best practice in building on permafrost - Locally train inspectors and contractors. Investigate gravel supply alternatives for local quar-riving, sieving and crushing - Provide engineering recommendations to the Hamlet regarding the development of low-lying, ponded land. What is the appropriate fill and drainage required from these sites? Are the mixed gravels nearby appropriate for grading and crushing for use as fill?
Lead organizations	- Hamlet - Nunavut Planning Department - Builders



Figure 5 Snow-buried deck

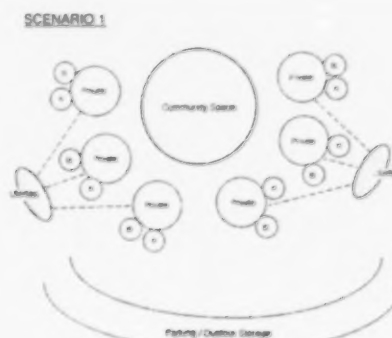


Figure 6 Relationship of living spaces

Step 5: Housing design

Issues

- The AHA determines the location and the orientation of houses on new lots.
- There is no input by future residents with the result that house designs do not meet cultural needs.
- There is no effort to keep extended families within close proximity to each other.
- There are few building regulations for private builders and no formal building inspection process.
- Existing zoning bylaws can inhibit housing innovations.
- Foundation issues, such as hard to adjust space frame post-construction need examining.

Solutions

- Offer more design options, including add-on units, unfinished interiors for residents to complete (after training).
- Use family-relationships to determine housing allocations to accommodate Inuit cultural needs. While single-family houses were preferred by most people in the teams, many also wanted to have housing space allocated so that extended families could live in close proximity of each other.
- Offer training (or advice) on solar and wind orientation.
- Require wind studies prior to issuing building permits to ensure that snow does not drift and block access to homes and roads.
- Investigate best options in terms of height of floor from ground level – a combination of snow accumulation and permafrost thawing issues.
- Consult with builders and others in North about best practices on permafrost.
- **Develop housing designs that are more responsive to the spatial needs of different lifestyles. Ideas include:**
 - An open kitchen plan and work surface design appropriate for the preparation of large game. Culturally adapted designs: meat crusher block for kitchen, local stone used in countertops, wire mesh shelving with gap for air circulation at walls. More appropriate work heights for different tasks.
 - Walk-in freezers: Exterior in-ground freezers were used traditionally and may be appropriate to construct again for storing game.
 - Workshops that offer space to repair equipment, build sleds, carve, etc. are needed. These would also provide another meeting place for Inuit men.
 - A cool dry area is needed for sewing skins.
 - More storage is needed – issues such as the difficulty in getting a permit to build sheds and the limitation that public units may not allow more storage space need to be addressed. In addition, solutions to the insurance barriers need to be explored.
 - Many families need larger bedrooms. In addition, houses with additional bedrooms to reduce overcrowding could be developed. Building techniques that offer the occupants the potential to easily change interior partitions could assist the long term and changing housing needs e.g., pods that can be added or taken away. Offer lower counters, cabinets to suit the Inuit stature.
 - Explore the potential to add modules to the basic housing unit for larger families to improve housing accessibility and flexibility. (An example is shown below).
 - Develop a Northern "Grow Home." These are smaller units for small families that have open interiors that can have partitions added by the occupants as needed.
 - There is cultural preference for ground related entries, although this aspect of height above ground needs to be balanced with the technical problems of permafrost melting and snow build-up.
 - House designs need to consider year round comfort. As centre units in multiplexes overheat in the summer, sun protection is needed in the design of these units.
 - Although homeowners can dedicate 25% of their homes as a small business, this is often prevented in rental units due to insurance and hamlet zoning bylaws. There is a need to address this issue in order to encourage and facilitate self sufficiency of tenants.

Lead organizations

- Nunavut Housing Corporation
- Local builder
- Arviat Housing Association
- CMHC (energy, research)
- Quliq (wind and alternative power)
- NRCan (alternative energy, research)

Step 6: Call for tenders/Award of contract

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|---------------------------|--|
| Issues | <ul style="list-style-type: none">■ Working drawings, material takeoffs must be completed within a tight timeline for meet shipping deadlines.■ There is some concern that the two-stage call for tenders (materials, then labour) may not be the most efficient approach.■ The complete process to occupation can take two years. |
| Solutions | <ul style="list-style-type: none">■ Consult with suppliers and local builders to find appropriate "shortcuts" and reduce barriers. |
| Lead organizations | <ul style="list-style-type: none">■ Nunavut Housing Corporation■ Builders■ Nunavut Government (regulations?) |

Step 7: Ordering and shipping of building materials

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|---------------------------|---|
| Issues | <ul style="list-style-type: none">■ The long time between the ordering and shipping of building materials means that, in many Northern communities, construction cannot begin in same year that the materials are shipped. In Arviat, for example, the change in shipping of materials by barge from Churchill to shipping by ocean freighter from Montréal has made it more difficult (depending on schedule and weather) to construct in the same year as materials arrive.■ There are major construction delays and increased costs when vital materials are missing. |
| Solutions | <ul style="list-style-type: none">■ Investigate more use of local materials including gravel, clay, snow as well as wind blocks and snow deposits.■ Consult with shippers to find better solutions. |
| Lead organizations | <ul style="list-style-type: none">■ Shippers■ Builders■ Others (manufacturers) |

Step 8: Construction and inspection

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|---------------------------|--|
| Issues | <ul style="list-style-type: none">■ While NHC inspects its own housing units, there is no formal process for building inspections in privately owned units. Upon request by the owner/builder, the NHC will inspect these units.■ The short building season limits the number of units that can be built in year.■ There is a shortage of building skills in the community. |
| Solutions | <ul style="list-style-type: none">■ Locally train building inspectors. While this would likely not be a full-time position, it could be part-time work for someone in the local building industry.■ Offer people the materials and training to construct their own homes.■ Research the use of local materials (gravel, clay) and snow for windbreaks. Eg. the treeline is close to Arviat and the small trees might provide construction material for housing. Need to verify sustainability of this slow-growing resource.■ Explore the options of prefabricating buildings locally over winter season. This could involve using community spaces that are unused in the winter, such as the swimming pool. |
| Lead organizations | <ul style="list-style-type: none">■ Nunavut Housing Corporation■ Local builders■ CMHC (research, training) |

Step 9: Maintenance and Operations

Issues

- High maintenance and operations costs
- High cost of delivery and removal of water
- Subsidized energy and water supplies – occupants do not know what the true costs are. There are no incentives for change to happen.

Solutions

- Education is needed on several fronts: educators, students and industry — on how houses operate as a system and about air leakage.
- Consider the use of combo systems that provide both heat and hot water in both new and existing houses using external utility rooms.
- Explore options to move service units (water, heating) out of the house into external utility units. The units could be designed to serve several housing units. This would improve the energy performance and reduce IAQ problems caused by fuel spillage.
- Pre-fabricate external utility units for water and heat that would serve several houses. Ship equipment to Arviat in containers and prefabricate the units during winter. The containers could be reused as the utility building. Advantages of external utility units include:
 - A potential savings of 2–3 weeks of construction time in the spring due to faster mechanical and power hook-up. Could be used for temporary heating as well.
 - Easier maintenance access with less technical equipment inside homes.
 - Would result in fewer penetrations through the building envelope for combustion air intake and so on. The lower chimney on the utility unit would make it easier to remove ice build-up in winter.
 - The reduced load on house floor system and foundations would allow for savings in construction costs.
 - Less disturbance and noise related to truck hauling, and less danger of pollution and fire inside the houses and spills into the environment.
 - Locating the oil storage container in an external utility unit could reduce theft. In addition, increase burner efficiencies in the furnace and reduce maintenance by burning warmer oil and allow the option of using a more eco-friendly biodiesel, B20 oil.
 - Equipment would be easier to replace and repair. If necessary one could simply bring a back-up utility unit.
 - Free-up space in existing buildings.
- Investigate alternative energy for power and backup power solutions for Arviat. One example is the use of boilers for heating.
- Energy efficiencies, space savings and reduced shipping costs might be gained by combining domestic hot water with in-floor radiant heat or radiant baseboards.
- For ventilation, an HRV could be located in the utility room or in the house.

Increasing housing lifespan

- A holistic approach is needed - addressing the issue of "nothing to do" for young people could offer multiple benefits in terms of their physical health and self-esteem. A secondary benefit would be reduced wear and tear on housing. (See Youth and Children Section below.)
- Increase the sense of pride in the home - provide maximum opportunities and incentives for tenants to contribute to design and construction.
- Promote community involvement in construction
- Home owner/occupant education including:
 - Providing training in how the houses work and resource conservation, including education in the schools.
 - Recognizing education as a three-step process: 1. Educate the educators. 2. Educate the students. 3. Educate builders and industry.
 - Provide incentives for people who achieve specific goals.

Solutions

- Utilize more durable finishes, especially for flooring. Eliminate the use of carpeting, which collects dust, contributes to asthma and wears quickly. Many households do not own a vacuum.
- The prevalence of mud, gravel and sand around the buildings increases floor wear. Provide screened gravel as alternative material around entries. Provide grates and shoe scrapers.
- Use Plexiglass protection for windows.
- Install large double sinks, including laundry and kitchen. In some communities, a bath in the laundry is used for butchering seals, etc.
- External utility unit as discussed previously.
- Use life-cycle costing, including operational and maintenance costs, to determine construction allowances.
- Use pile foundations rather than space frames that cannot be adjusted on shifting sites.
- Steel roofs are most durable.
- Need separate resource conservation programs for tenants and for owner/landlords.
- Partners in education should include:
 - Nunavut Housing Corporation
 - Hamlet of Arviat
 - Arctic College
 - Office of Energy Efficiency (Natural Resources Canada)
 - Department of Education of Nunavut
 - Nunavut Department of Health and Social Services
 - Department of Environment of Nunavut
 - Quliq Energy Centre
 - Arctic College

Resource Efficiency and Alternative Energy

- Passive solar and climate-optimized designs are needed – orientation for sun, wind and snow must be considered.
- Reduced energy loads are the first step to using alternative sources.
- Provide a drying space in units. (Drying closet)
- Water storage tanks do not have enough capacity. Install bigger tanks or explore small reuse water systems, such as Advantex AX 20 at www.orneico.com
- Cool water can also be circulated and used to temper air.
- More energy and water saving appliances are needed. Discuss with stores to offer only the top Energy Star appliances, lights, etc. Rebates? Lights, especially the more expensive fluorescent lights, need to be protected by cages, as they are easily broken.
- In a hot air system, recirculate hot air from upper room and house levels by drawing it down through a vertical duct to floor level, to maintain a more balanced room temperature.
- Exceed R-2000 quality – insulation and air sealing is cheap, relative to annual costs for heat.
- Wind generation is already used in Arviat. (Explore options further with Natural Resource Canada and QEC.)
- Geothermal sources may be feasible from below permafrost.
- Sea water source for heat pump and wave energy generator when ice is gone.
- Portable PV battery chargers are available that could be used for skidoos and CBs in cabins for part of the year.
- Co-generation of heat and electricity for many houses
 - Burned waste from dump
 - Micro diesel for electricity and home heat (Resolute Bay hotel)
 - Heat from power generation is already used in the three schools.

Solutions

- Build traditional freezers for storing meat.
- Solar water heaters could function from March to the end of November. They might have to be installed by the QEC. This should be discussed to eliminate real or perceived barriers. Snow drifting, orientation and rock throwing need to be considered.

Lead organizations

- Arviat Housing Association
- Nunavut Housing Corporation
- NRCan (builder training, energy use, alternative energy)
- Quliq (energy alternatives)

Youth and Children

The charrette groups identified health and children's activities as priority needs for the community. The groups decided that this subject needs be considered in more detail by the community, with input from more young people and those who work with them. It was noted that over half of the children had substance abuse problems. Suicides are also a serious problem, but the charrette did not address this sensitive subject.

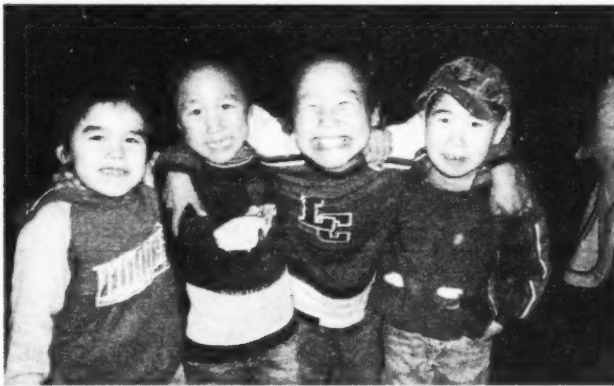


Figure 7 Arviat kids

- The groups felt that children's play areas, directed activities and energetic youth coordinators are critical community priorities.
- The groups suggested more access for young people to the school gymnasium and wondered if the swimming pool season could be extended and the underused curling rink be used for other activities, such as skateboarding.
- Young people appreciate summer camp activities and more of such activities would be welcome.

- Young people need to be recognized as important contributors to their community. In-house training in home design, building, surveying and related skills would give them with a sense of purpose and self-reliance.
- Elders teaching igloo construction, and in the future, traditional freezer construction would benefit young people and the community.
- Student science projects could investigate solar space heating adapted for the region. Arctic College has an environmental technology programme.

The charrette groups suggested that the community Health Unit, the department of education, school principals, the Hamlet of Arviat, the Arviat Housing Association and young people themselves would be lead organizations in developing solutions.

CONCLUSIONS

The charrette participants raised a broad spectrum of issues and suggested many solutions: some feasible in the short term; some requiring long-term development, research and consultation.

In setting priorities, the solutions creating the greatest changes will likely be those that provide multiple benefits — that is, they will help to solve more than one issue at a time. For example, training and employing young people from the community to prefabricate small units, and offering them the opportunity to be housed first, would provide them an incentive, develop their sense of self-sufficiency and give them a better understanding of how their houses work. Besides helping to reduce the housing backlog, this would also provide young people with an income and means of support.

Similarly, developing a separate external utility unit, assembled in Arviat, would also promote speedier construction and provide several other benefits at the same time.

Research Highlight

Arviat Community and Housing Design Charrette

Discussion of construction process issues with the important stakeholders may lead to more integrated solutions that could benefit all. The Arviat charrette was only the start of an integrated approach that can be continued through more dialogue and solution-finding. While certain stakeholders have more investment in parts of the process, it is only in working together with the others on common goals that the most appropriate solutions can be found. However, community engagement throughout this process will be needed to guide the decision-making. Short-term actions are needed to fulfil the long-term vision of more suitable and affordable homes.

Over the next months, Nunavut Housing and Canada Mortgage and Housing Corporation will work together to carry out those solutions that are presently possible, to eliminate barriers that may lead to more effective housing delivery and to research alternative methods and technology for future implementation. Other organizations are invited to join this process.



Figure 8 Hockey on one of the Arviat ponds

CMHC Project Manager: Sandra Marshall

Housing Research at CMHC

Under Part IX of the *National Housing Act*, the Government of Canada provides funds to CMHC to conduct research into the social, economic and technical aspects of housing and related fields, and to undertake the publishing and distribution of the results of this research.

This fact sheet is one of a series intended to inform you of the nature and scope of CMHC's research.

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